Claims

1. A phased-locked microdischarge array, comprising:

a substrate;

a plurality of microdischarge cavities in said substrate containing discharge medium, said microdischarge cavities being sized and arranged such that at least some of the microdischarge cavities are within the coherence length of, at least one emission line produced by said discharge medium contained in said microdischarge cavities;

at least one pair of electrodes for exciting said plurality of microdischarge cavities for excitation of said discharge medium by application of electrical power.

2. The microdischarge array of claim 1, wherein said at least one pair of electrodes are isolated from each other and said discharge medium such that ac, rf, or pulsed excitation applied to said pair of electrodes stimulates discharge from said discharge medium.

3. The microdischarge array of claim 2, wherein a dielectric layer isolates said at least one pair of electrodes from each other and said discharge medium.

4. The microdischarge array of claim 3, further comprising a protective layer between said dielectric layer and said plurality of microdischarge cavities.

5. The microdischarge array of claim 1, wherein said microdischarge cavities array are arranged to approximate a Fresnel pattern, and groups of said microdischarge cavities comprise approximate rings in the Fresnel pattern.

6. The microdischarge array of claim 1, wherein said substrate comprises one of said at least one pair of electrodes and said microdischarge cavities are formed as a hollow cathodes that penetrate said substrate, the array further comprising:

a transparent electrode forming the other of said at least one pair of electrodes; and

a dielectric layer to isolate said transparent electrode from said substrate.

7. The microdischarge array of claim 6, wherein said plurality of microdischarge cavities are arranged to approximate a Fresnel pattern.

8. The microdischarge array of claim 1, wherein said plurality of microdischarge cavities are arranged to approximate a Fresnel pattern.

9. The microdischarge array of claim 1, wherein said substrate comprises photosensitive glass, with said plurality of microsdischarge cavities etched into said photosensitive glass.

10. The microdischarge array of claim 1, wherein said discharge medium is selected from the group consisting of the atomic rare gases, N_2, and the rare gas-halide molecules.

11. The microdischarge array of claim 10, wherein said discharge medium comprises neon gas.

12. An optical communication system, comprising:

a microdischarge array of claim 1, the array being optically coupled to an optical transmission medium; and

a controller for controlling delivery of electrical power to said at least one pair of electrodes to stimulate said microdischarge array to launch optical power into said optical transmission medium.

13. The optical communication system of claim 12, wherein said optical transmission medium comprises an optical fiber.

14. A flow cytometry system, the system comprising:

a microdischarge array of claim 1;

a flow system including an examination station disposed at a focal length of the microdischarge array for passing living cells within the focal length of the microdischarge array; and

a controller for controlling delivery of electrical power to said at least one pair of electrodes to stimulate said microdischarge array to direct optical power into said examination station.

15. A memory device, the device comprising:

a microdischarge array of claim 1;

a memory medium disposed at a focal length of the microdischarge array; and

a controller for controlling delivery of electrical power to said at least one pair of electrodes to stimulate said microdischarge array to direct optical power onto said memory medium.

16. The microdischarge array of claim 1, wherein said at least one pair of electrodes are separated from said discharge medium to excite said discharge medium when ac, rf, or pulsed power is applied to said electrodes.

17. The microdischarge array of claim 1, wherein said at least one pair of electrodes is arranged to have an electrode directly contact said discharge medium to excite said discharge medium when ac, RF, pulsed or dc power is applied to said electrodes.

18. The microdischarge array of claim 1, further comprising means for sealing said discharge medium in said plurality of microdischarge cavities.

19. The microdischarge array of claim 1, further comprising a grating optically coupled to said microdischarge cavities.

20. A microdischarge array, comprising:

a substrate;

a plurality of microdischarge cavities in said substrate and arranged in a Fresnel pattern, at least a portion of the substrate between said plurality of microdischarge cavities being optically transparent to an emission wavelength of the microdischarge array;

discharge medium contained in said microdischarge cavities; and

electrodes for stimulating said discharge medium.

21. A microdischarge array, comprising:

a semiconductor substrate;

at least one pair of electrodes;

an insulation layer to isolate said electrodes from said semiconductor substrate;

a dielectric layer to isolate said at least one pair of electrodes from each other;

a dielectric substrate;

a plurality of microdischarge cavities containing discharge medium in said substrate and arranged to produce a phase-locked response when excited, said plurality of microdischarges being physically isolated from said at least one pair of electrodes by said dielectric layer; and

a transparent layer sealing the discharge medium said plurality of microdischarge cavities.

22. A microdischarge array of claim 21, further comprising a protective layer disposed between said plurality of microdischarge cavities and said dielectric layer.

23. The microdischarge array of claim 21, further comprising a grating optically coupled to said plurality of microdischarge cavities.

24. The microdischarge array of claim 21, wherein all of said microdischarge cavities lie within one coherence length of at least one emission line produced by the discharge medium from all other ones of said microdischarge cavities.

25. A microdischarge device, comprising:

a semiconductor substrate;

at least one pair of electrodes;

an insulation layer to isolate said electrodes from said semiconductor substrate;

a dielectric layer to isolate said at least one pair of electrodes from each other;

a dielectric substrate;

a microdischarge cavity containing discharge medium in said substrate and being physically isolated from said at least one pair of electrodes by said dielectric layer; and

a transparent layer sealing the discharge medium in said microdischarge cavity.